

REMARKS

Claims 7-12 having been withdrawn from consideration, Claims 1-6 are now presented for examination. Claim 2 has been cancelled without prejudice or disclaimer of subject matter. Claims 1 and 3-6 have been amended to define still more clearly what Applicants regard as their invention, in terms which distinguish over the art of record. Claim 1 is the only independent claim.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "706" at paragraph [0046] and "206" at paragraph [0091] have both been used to designate the workpiece substrate having a resist coating 707 for exposure in the near-field exposure apparatus as shown by Figure 7. The specification has been amended at paragraph [0091] to change "substrate 206" to -- substrate 706--.

The drawings have also been objected to in that in Figure 2, reference characters "204" and "208" do not refer to the features as described at page 32, lines 9-22, paragraph [0106-0107], in which "204" should represent the second slit opening(s) and "208" should represent the area crossed by both the gaps between patterned light shield portions 206 and the second slit openings 204 and in Figure 3, reference characters "308" do not refer to the area crossed by both the gaps between light shield portions 306 and the second slit openings 304, as described at page 33, lines 9-22, paragraph [0109-0110]. Figs. 2 and 3 have been amended as on the attached replacement drawing sheets to clearly indicate that "204" represents the second slit opening(s) and "208" represents the area crossed by both the gaps between patterned light shield portions 206 and the second slit openings 204. Fig. 4 has been amended to indicate more clearly that "408" represents

a crossed area. The proposed changes to Figs. 2, 3 and 4 are shown in the enclosed replacement drawing sheets. Approval of the changes is respectfully requested.

The specification and the abstract have been carefully reviewed. A substitute specification excluding the claims is hereby submitted under 37 C.F.R. § 1.125(b) to correct the errors noted by the Examiner, typographical errors and to improve idiomatic English. The substitute specification includes no new matter and has been prepared to correct typographical errors and to improve idiomatic English. A marked-up copy of the substitute specification showing the matter being added to and the matter being deleted from the specification of record is attached. The changes in the substitute specification are believed clearly not to affect the scope of the claims.

With respect to the errors noted by the Examiner, paragraphs [0003], [0007], and [0029] have been amended to overcome the objections thereto. Paragraphs [0032] through [0036] has been amended to indicated that the near-field light is more intense at edges of the slit opening perpendicular to the direction of the incident-light electric field than at edges of the slit opening parallel to the direction of the incident-direction electric field. Support for the amendment to Paragraphs [0032] through [0036] may be found in the originally-filed specification at page 8, lines 13-20, and at page 10, line 17 through page 11, line 2. With regard to the objection to the specification for providing two different thickness ranges for the base 601 in paragraphs [0039] and [0041], the substitute specification amends paragraph [0041] to indicate that the thickness range discussed there relates to a preferred embodiment of the invention. Paragraphs [0032] and [0033] have been amended in the substitute specification to explain more fully how the

polarization of light in the direction of the first slit openings exposes the resist under only the areas crossed by the light shield portions and the second slit openings.

Claim 5 objected to for minor informalities has been amended in accordance with the Examiner's suggestions.

Claims 4 and 6 have been rejected under 35 U.S.C. § 112, first paragraph in that these claims fail to fully explain how polarization of incident light as shown in the instant figures to be in the same direction as the first slit openings (e.g., 103 in Figure 1, etc.) results in exposing only the resist under the areas crossed by both the gaps between patterned light shield portions (e.g., 106 in Figure 1, etc.) and the second slit openings (e.g., 104 in Figure 1, etc.); and preventing exposure of the resist under the first slit openings.

Claim 4 has been amended to recite that the openings formed in the light shield film are configured and positioned to generate near field light in a square dot pattern on an exposed area of the exposure target. Claim 6 has been amended to recite that the light illuminating means illuminates the near field photomask with polarized light which has an electric field component parallel to the rows of first slit openings and that the positioning means positions the near field photomask at a distance from the exposure target within a near field range thereof. Accordingly, it is believed that Claims 4 and 6 as currently amended fully explain the incident light polarization features of the invention and fully meet the requirements of 35 U.S.C. § 112, first paragraph.

Claims 1, 2 and 4 have been rejected under 35 U.S.C. § 102 as being anticipated by the patent to Ebbesen et al. (U.S. Patent No. 6,236,033).

Independent Claim 1 as currently amended is directed to a near field photomask in which a light shield film and openings are formed in the light shield film. The openings generate near field light in response to receiving incident light. The generated near field light is usable to expose an exposure target with the near field light. The openings formed in the light shield film have two or more parallel rows of first slit openings each having a width smaller than 100 nm and two or more parallel rows of second slit openings having a width smaller than 100 nm that extend perpendicularly to two or more parallel rows of first slit openings and interlink at least two of the rows of first slit openings. A unit forms plural discrete, spaced apart latent dot image formed areas, spaced apart from each other along two perpendicular directions on the exposure target in response to each of the openings receiving polarized light having an electric field component parallel to the two or more parallel rows of first slit openings.

In Applicants' view, Ebbesen et al. discloses an enhanced light transmission apparatus in which at least one aperture extends from a first surface to a second surface of a metal film. A periodic surface topography is provided on at least one of the first and second surface of the metal film. Light incident on one of the surfaces of the metal film interacts with a surface plasmon mode on at least one of the surfaces of the metal film thereby enhancing transmission of light through the at least one aperture in the metal film. The apparatus may have a single aperture or a plurality of periodically arranged apertures. Wavelength-selective optical filters, spatial optical filters, light collectors, near-field scanning optical microscope probes and photolithographic masks are provided.

It is one feature of Claim 1, that two or more parallel rows of second slit openings extend perpendicularly to two or more rows of first slit openings. Ebbesen et al. may teach one second slit opening interlinking a pair of first slit openings. The H shaped opening in Ebbesen et al., however, is restricted to having only one second slit opening perpendicular to a pair of first slit openings which is completely different from the arrangement of the present invention where two or more parallel rows of second slit openings extend perpendicularly to two or more parallel rows of first slit opening. Accordingly, Ebbesen et al. fails in any manner to teach the two or more parallel rows of second slit openings perpendicular to the two or more parallel rows of first slit openings as in Claim 1.

It is another feature that means forms a plurality of discrete, spaced apart latent-dot-image formed areas, spaced apart from each other along two perpendicular directions on the exposure target in response to each of the openings receiving polarized light having an electric field component parallel to the two or more parallel rows of first slit openings. Ebbesen et al. only shows an arrangement of polarized light in Fig. 7 of incident light angled with respect to an array of apertures. There is no teaching or suggestion in Ebbesen et al. of polarized light having an electric field component parallel to the two or more parallel rows of first slit openings as in Claim 1. It is therefore believed that Claim 1 as currently amended is completely distinguished from Ebbesen et al. and is allowable thereover.

Claims 1-5 have been rejected under 35 U.S.C. § 102 as being anticipated by the patent to Kuroda et al. (U.S. Patent No. 6,171,730) or under 35 U.S.C. § 103(a) as unpatentable over Kuroda et al. '730. Claim 6 has been rejected under 35 U.S.C § 103(a) as being unpatentable

over the patent to Kuroda et al. '730 in view of the patent to Ebbesen et al. (U.S. Patent No. 6,236,033) and/or the publication to Alkaiasi, M. M. Et al. ("Sub-diffraction-limited patterning using evanescent near-field optical lithography", (1999) Applied Physics Letters, Vol. 75, No. 22, pp 3560-3562).

In Applicants' opinion, Karoda et al. '730 discloses an exposure arrangement that transfers a pattern to an object to be exposed by exposure to evanescent light using a mask having an aperture pattern having a width of 100 nm or less. The mask is arranged opposite to the object to be exposed, and pressure is applied to the mask arranged opposite to the object from the side of the mask opposite to the surface facing the object to generate evanescent light under the pressure applied, to transfer the pattern of the mask to the object to be exposed by exposure to the evanescent light.

Karoda et al. '730 may show aperture patterns for evanescent light. All the aperture patterns in Kuroda et al. '730, however, are L shaped aperture patterns. The Kuroda et al. '730 disclosure is devoid of any teaching or suggestion of an arrangement of interlinked perpendicular first and second slit openings and the Examiner has not cited any reference with the interlinked perpendicular first and second slit opening structure as in Claim 1. Further, it is another feature of Claim 1 that a plurality of discrete spaced apart latent dot image formed areas spaced apart from each other along two perpendicular directions on an exposure target are formed responsive to each of openings receiving polarized light having an electric field component parallel to two or more parallel rows of first slit openings. As a result, it is not seen that Kuroda et al. '730 which lacks the interlinked perpendicular first and second slit openings and the application of polarized

light having an electric field component parallel to the parallel rows of first slit openings could possibly teach or suggest the features of Claim 1. It is therefore believed that Claim 1 as currently amended is completely distinguished from Kuroda et al. and is allowable thereover.

Claims 1-5 have been rejected under 35 U.S.C. § 102 as being anticipated by the patent to Kuroda et al. (U.S. Patent No. 6,187,482) or under 35 U.S.C. § 103(a) as unpatentable over Kuroda et al. '482. Claim 6 has been rejected under 35 U.S.C § 103(a) as being unpatentable over the patent to Kuroda et al. '482 in view of the patent to Ebbesen et al. (U.S. Patent No. 6,236,033) and/or the publication to Alkaisi, M. M. Et al. ("Sub-diffraction-limited patterning using evanescent near-field optical lithography", (1999) Applied Physics Letters, Vol. 75, No. 22, pp 3560-3562).

Kuroda et al. '482, in Applicants' view, discloses a mask used in an evanescent light exposure apparatus wherein the mask has a front side provided with minute aperture patterns and is disposed opposite an object to be exposed. The mask is irradiated with light from its back side, and the object is exposed to the minute aperture patterns, whereby the patterns are transferred thereto, by evanescent light that emerges from the minute aperture patterns. The outermost surface on the front side of the mask has an adsorption preventor.

As aforementioned, it is a feature of Claim 1 that two or more parallel rows of second slit openings extend perpendicularly to two or more rows of first slit openings and that the second slit openings interlink at least two of the rows of first slit openings. Kuroda et al. '482 only teaches hook shaped aperture patterns as shown in Fig. 3A. While Kuroda et al. may suggest other patterns, there is no teaching or suggestion of interlinking of at least two parallel rows of

first slit openings with parallel rows of second slit openings as in Claim 1 and no reference has been cited that discloses such an interlinking arrangement. Further, it is not seen that Kuroda et al. '482 teaches or suggests the feature of Claim 1 of means for forming a plurality of discrete, spaced apart latent-dot-image formed areas, spaced apart from each other along two perpendicular directions on the exposure target in response to each of the openings receiving polarized light having an electric field component parallel to the two or more parallel rows of first slit openings. Accordingly, it is not seen that Kuroda et al. '482 in any manner suggests the combination of these features of Claim 1. It is therefore believed that Claim 1 as currently amended is completely distinguished from Kuroda et al. and is allowable thereover.

Claims 1-5 have been rejected under 35 U.S.C. § 102 as being anticipated by the publication to Yang (U.S. Patent Application Publication No. 2005/0026047).

Yang, in Applicants' opinion, discloses a mask for reducing proximity effect that has plural line shaped features. Plural first assist features are positioned between the line shaped features and plural second assist features positioned between the line shaped feature and the first assist feature. The line-shaped feature corresponds to isolation trenches to be formed on a silicon wafer. The first assist feature is rectangular in shape and has a larger width at the direction perpendicular to the line-shaped features. The width of the second assist feature is smaller than two-fifths of the wavelength but larger than one-fourth of the wavelength of an exposure source. The size of the first assist feature and the second assist feature is so designed to be non-resolvable, while the line-shaped feature is resolvable and transferred to the silicon wafer.

Yang may teach a mask with assist features that are non-resolvable and line shaped features that are resolvable. Only the line shaped features are transferred to a silicon wafer. In contrast to Yang's transferring only of line shaped features in a mask, it is a feature of Claim 1 that forming means form plural discrete, spaced apart latent-dot-image formed areas, spaced apart from each other along two perpendicular directions on an exposure target in response to each of the openings receiving polarized light having an electric field component parallel to two or more parallel rows of first slit openings. Accordingly, it is not seen that Yang's mask which transfers only line shaped features to a silicon wafer in any manner teaches or suggests the forming of plural discrete spaced apart latent-dot-image formed areas as in Claim 1 in response to polarized light having an electric field component parallel to two or more parallel rows of first slit openings. Further, the filing date of the Yang publication is after the priority date of the present application. It is therefore believed that Claim 1 as currently amended is completely distinguished from Yang and is allowable.


For the foregoing reasons, Applicants submit that the present invention, as recited in independent claim 1, is patentably defined over the cited art.

Dependent claims 3-6 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicants' attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



Attorney for Applicants
Jack S. Cubert
Registration No. 24,245

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3800
Facsimile: (212) 218-2200
DC_MAIN 222146v1